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INDUSTRIAL PREPAREDNESS IN AN ARMS CONTROL ENVIRONMENT: A STUDY OF THE POTENTIAL IMPACT OF SHARP INCREASES IN MILITARY PROCUREMENT. VOLUME II. COMPLETE REPORT

Arthur D. Little, Incorporated

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A STUDY OF THE POTENTIAL IMPACT OF SHARP INCREASES IN MILITARY PROCUREMENT

ACDA/MEA-246

PREPARED FOR

U.S. ARMS CONTROL AND DISARMAMENT AGENCY

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VOLUME II

COMPLETE REPORT

This report was prepared under contract with the United States Arms Control and Disarmament Agency. The judgments are those of the authors and do not necessarily reflect the views of the United States Arms Control and Disarmament Agency or any other department or agency of the United States Government.

ACDA/MEA-246

PREFACE

To be viable in the long run, an arms control agreement -- like any other international agreement -- has to be in the interest of all the major parties. If it is indeed in the interest of the major parties, this fact alone should suffice to prevent abrogations or violations. Since arms control agreements are so basic to national security, however, we have consistently sought additional assurances to make them possible, in the first instance, and viable later on. In particular, we have insisted upon adequate verification, to assure ourselves that the terms are being lived up to. In evaluating the feasibility of an arms control agreement, we have also given full consideration to the consequences which would be suffered by another party if it chose to violate or abrogate. Such consequences might be political, economic, military, or some combination of these. The prospect of adverse consequences obviously promotes arms control, making possible arms control measures which otherwise might not seem feasible.

An important deterrent to abrogation or violation of an arms control agreement is our known ability to redress a sudden military imbalance rapidly if the need should occur. With this in mind, the Arms Control and Disarmament Agency contracted for a study to be made which would evaluate the US capability to respond to military threats without having to maintain American military capability at peak level.

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I. INTRODUCTION

This is the report on an eight-month exploratory study of U.S. industrial preparedness in an arms control environment, prepared by Arthur D. Little, Inc. (ADL) under a contract with the United States Arms Control and Disarmament Agency (ACDA).

The backdrop for the study is the international environment in which arms control measures are gradually evolving. The 1970's have witnessed the opening of a new chapter in relationships among the superpowers--the United States and the USSR. Initialing of the SALT I agreements on May 28, 1972, and the beginning of SALT II and negotiations for MBFR more recently, are evidence that a continuing process of bilateral accommodation of supreme national interests is under way that is likely to extend over many years. The existence and prospective continuity of this process introduces into many aspects of strategic policymaking a novel element, the implications of which merit thoughtful, fresh appraisal and--no doubt--continuing reappraisal as new relationships evolve.

This is as true of policies on national industrial preparedness as it is of those determining the directions of military research and development, manpower mobilization, or the peacetime deployment of conventional armament. Each of these elements of strategic posture is impacted by, and reciprocally can impact on, the changing balances of the perceived positions of the negotiating parties and ultimately the relationships staked out in final agreements.

It is our understanding that a logic such as this suggested to ACDA that the time was ripe for a fresh look at industrial preparedness policies and processes. The well-recognized human tendency to plan for the future in terms of the past would alone justify an occasional inquiry to make certain that newly-emerging conditions--of which ACDA is in a superior position to be aware, so far as arms control activities are concerned--are adequately reflected in all contingency planning. In the case of industrial preparedness there were the special possibilities to be explored, that a smoothly-responsive process for moving from a particular level of preparedness posture to another, could be useful to negotiators in SALT or MBFR

- to strengthen the credibility of the U.S. as a military power with effective industrial mobilization capacity or

- to be used as a signalling device or a "bargaining chip".

These values would be complementary to the normal function of industrial preparedness as a safeguard against being unready to respond to hostile action (or the threat of hostile action) involving conventional arms. It also is possible that an understanding of the relationships between disarmament programs and industrial preparedness programs will provide insights valuable in the design of future arms control strategies and proposals.

Against this backdrop, the key questions addressed in this study were (1) whether the industrial mobilization capability of the United States in the late 1970's and the 1980's requires improvement to serve its multiple objectives in an arms control setting; and (2) if so, the directions in which a program of improvement should go. Related questions raised by the terms of reference for the study include:

- Whether the preparedness system is so geared as to be useful to arms control negotiators as a signalling device or bargaining chip.

- Whether the industrial mobilization-control mechanism is organized so as to be able to function effectively at significant levels of intensity without causing inordinate competition with the peacetime production base for civilian goods.

- What are the predictable bottlenecks to industrial mobilization?

- Is there evidence that, at some foreseeable levels of industrial mobilization in an arms control environment, the industrial base--or significant parts of it--would be unable to absorb the fiscal resources that are programmed for expenditure (as was the case in the mobilization for the Korean war)?

- Are there special problems for the industrial preparedness program created by the possibility that violation of a MBFR agreement might require preparations or production for a conventional war in Europe, either on top of other industrial mobilization demands or merely as addenda to normal peacetime economic activity?

- What special problems are posed for industrial preparedness programming by a continuing environment of detente?

- What further study programs are indicated which would improve U.S. industrial mobilization capabilities (a) at low cost or (b) at any reasonable cost in the light of the benefits achievable?

The methodology adopted for the analysis was a combination of macro- and microeconomics. The macroeconomic approach involved first a forecast of the U.S. economy into the 1980's assuming no mobilization and then an estimate of the broad impact on that economy should a mobilization of specified dimensions actually occur. The microeconomic analysis, designed to test the capability of key weapon-producing industries to respond to a postulated level of mobilization, was based on extensive interviewing of executives in industries which would be involved in such a mobilization. The interviewing program served two purposes. The first was to establish a limit on the intensity of the mobilization below which the system would absorb it easily and above which severe problems were likely to occur. The second purpose was to interpret the results which came from the macroanalysis. The methodology is described more fully in Chapter II.

The combined analyses are presented in Chapters V and VI. In this discussion we contrast the growth rates required by the postulated mobilization (macroanalysis) with the growth rates that are considered feasible for a given industry (microanalysis). The critical industries are considered in terms of their functions in weapons production, namely, final assembly, supply and support. Based on this integration, we are able to identify those industries which will develop bottlenecks and what the nature of these bottlenecks will be.

Finally, in Chapter VII we set forth the general conclusions we have reached on the capabilities of the economy to respond to a mobilization, its usefulness as a bargaining chip in negotiations, and the factors which limit the scale of a mobilization in the U.S. in the last half of this decade.

II. THE STUDY APPROACH

A. INTRODUCTION

This is a study of U.S. industrial mobilization capability.[1] At the macroeconomic level a parametric approach has been taken in the sense that emphasis has been given to identifying key relationships important to mobilization potential among the fundamental elements of the system being studied (the U.S. economy) rather than to consideration of specific scenarios in which such relationships would be varied. At the same time, it has been necessary to illustrate these relationships by reference to the economy in a "normal" (non-mobilization) state and, for comparison, after the impact of a specified level of industrial mobilization has perturbed it. At the microeconomic level, mobilization capability has been studied by assessing the probable response of key defense industries to the postulated level of mobilization orders implicit in the macroeconomic illustration.

B. BASIC STEPS OF THE ANALYSIS

The analysis proceeded through seven steps:

1. The first step was to identify the elements that could be critical in determining the economy's ability to respond effectively to sharp increases in military procurement. These elements, referred to as parameter sets, listed in Table 1, were derived by the exercise of the collective judgment and experience of the study team. While the focus of the study has been on economic factors, non-economic factors are included among the mobilization

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1 Throughout this study we use the terms "mobilization" and "sharp increase in military procurement" interchangeably. There obviously can be many degrees and variances of each, ranging from a substantial and relatively rapid increase in procurement of one or a few classes of weapons or weapon systems to a full scale mobilization of a large proportion of the U.S. economy such as occurred in World War II. We try, whenever possible, to define what degree is referred to; specifically, in the "test case" referred to in Chapter IV, we hypothesize a "mobilization" far short of the World War II dimension, even though it is scaled to a level that would put considerable stress on the economy.

TABLE 1

SELECTED PARAMETER SETS AFFECTING THE SYSTEM TO BE STUDIED

STATUS OF THE U.S. ECONOMY

- Level of inflation
- Level of employment
- Level of income
- Position in the business cycle
- Balance of payments
- Cost and availability of capital
- Federal budget vs. revenues
- Structure of the economy (I/O relationships)
- Consumption levels
- Stockpile levels

STATUS OF U.S. DEFENSE INDUSTRIES

- Capacity utilization
- Profitability of military production
- Availability of production inputs (i.e., labor, raw materials, capital and intermediate goods)
- Split between civilian and military production
- Flexibility to substitute between military and civilian production
- Willingness of management and labor to modify existing operations

TABLE 1 (Continued)

STATUS OF SPECIFIC WEAPON SYSTEMS

- Position in their development/procurement cycle
- Complexity of the weapon system
- Lead times for tooling up and obtaining inputs
- In-process and component inventory
- Willingness to utilize "off-the-shelf" models
- Relationship between time, performance and cost factors

SOCIOPOLITICAL SITUATION

- Attitude of society toward increased military expenditures
- Attitude toward increased taxation or reduction in federal budget expenditures
- Willingness to experience governmental controls, such as rationing, wage and price controls, and constraints imposed under the Defense Production Act
- Personal political risk associated with involvement

INTERNATIONAL SETTING

- Status of allied economies
- Status of sea lanes of communications
- Access to vital imports
- Access to export markets
- Need of allies for continued U. S. exports, particularly military hardware
- Nature of treaties
- Attitudes of other nations

TABLE 1 (Continued)

LEGAL AND ADMINISTRATIVE MECHANISMS CRITICAL TO MOBILIZATION

- Laws and Executive Orders
- Procedures and organization of governmental agencies having responsibility for mobilizing industry
- Congressional appropriations procedures
- DOD contractual procedures and organization

parameter sets since they strongly influence the proficiency with which the economy can respond.

2. A future to 1980 was forecast in which no deviation from presently planned military procurement is assumed to occur. This forecast is referred to as the base case or the setting for the study. It is described in terms of the parameter sets listed in Table 1. The outlook for the U.S. economy was based on an application of the ADL Long-Term Forecasting Model (described in Appendix A). The projected status of major defense industries in that economy was based on extensive interviews of defense industry executives conducted by ADL industry specialists.

3. Using the ADL 215-sector, interindustry Input/Output table, the relationships between (a) final sales in the major military procurement categories[1] and (b) sales in each of the industries directly and indirectly affected by military procurement were established. Thus, for each major military procurement category an impact ratio has been derived which indicates the total sales directly and indirectly resulting in each affected industry from $1 million of sales in that procurement category.

4. A test case military procurement schedule was designed for the purpose of perturbing the system sufficiently to expose stress points in the economy as well as to raise the probability of bottleneck development in key defense industries. The problem framework was expressed as:

- Given:

  (a) the status of the U.S. economy;

  (b) the status of specific defense-related industries;

  (c) the status of specific weapons systems;

  (d) the domestic sociopolitical environment;

  (e) the international environment; and

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[1] The major military procurement categories are aircraft, missiles, weapons and tracked vehicles, ships, ammunition and other.

(f) the legal and administrative mechanisms for mobilization.

- What constraints would these conditions impose on the test case mobilization effort; and

- What impact would the mobilization have, in turn, on the status of the U.S. economy and on key defense industries?

5. Using the ADL Long-Term Forecasting Model, the projected impact of the test case was looked at from a macroeconomic perspective. Sales and employment resulting, directly and indirectly from the test case, throughout each of 215 industries, were determined. Also, an appraisal was made of the national implications of the test case with regard to inflation, monetary and fiscal policy, balance of trade, and other significant factors.

6. Analysis at the macroeconomic level is likely to be insufficiently detailed to identify particular, possibly critical, bottlenecks to expanded production. Moreover, the capacity of plants and industries as measured in economic data based on peacetime assumptions may understate capacity for multishift operations during a mobilization. To compensate for these limitations a program of microeconomic analysis, at the industrial level, was carried out. This was based on a substantial series of meetings between ADL industry specialists and senior executives in defense industries knowledgeable in estimating the specific impact of the test case procurement on their own operations. The ADL industry specialists, already familiar with the rest of the 215 industries covered in the ADL I/O table, were then requested to evaluate the impact of the procurement level and other economic factors implicit in the test case on the respective final assembly, supply, and supporting industries principally involved in mobilization. In particular they were asked to form judgments on the capability of such industries to respond to the test case at the level of production and rate of increase indicated. If the industry specialists, taking into account the estimates of industry executives, judged that a particular industry could not meet the required output projected by the ADL Forecasting Model without government intervention, disruption of civilian production or other deviation from normal peacetime routine, a test case bottleneck was implied in that industry.

7. The implications of the test case (a) for the U.S. economy as a whole and (b) for the key defense industries were characterized. In this process the significance of the international and domestic economic/political setting as a constraint on mobilization options emerged.

If time and resources had permitted, a logical next step would have been to vary the assumptions regarding military procurement used in the test case in order to plot out related changes in impact under variant assumptions. Fortunately, however, as we shall indicate below, this step is not essential to a useful analysis.

C. POSITIVE FEATURES AND LIMITATIONS OF THE APPROACH

The approach described above has positive features as well as limitations that are worthy of note.

One of the most important positive features is use in the analysis of human judgment based on extensive experience. This has played a critical role at several levels:

- The ADL Input/Output Table (described in Appendix A) contains an up-to-date set of technical coefficients. These technical coefficients, which state the relationship between a unit of output in an industry and the inputs required from each of its suppliers to produce this output, change over time as the technology and economics of industries change. The ADL Table does not, as most other I/O tables do, rely solely on published statistics; it is updated and projected periodically by in-house industry specialists who are closely familiar with current trends in the industries. The tables used in this study reflect this intimate and current knowledge.

- Reliance on human judgment has also been a key factor in the evaluation of the implications of the test case when applied to the ADL Long-Term Forecasting Model. The Long-Term Forecasting Model is basically an Input/Output model and therefore cannot fully take into account all real-life aspects of the economy. Therefore, ADL industry specialists who have close knowledge of the industries in the I/O table evaluated the

forecast growth rate implied in the test case, adding their insights. For example, they were able to point to capacity problems as well as capacity reserves not apparent in the unevaluated output of the Model and were also in position to indicate regional implications which the Model cannot explicitly identify. These insights were strengthened by the inputs of the many senior industry executives interviewed by the specialists.

Strengths and weaknesses of the ADL Long-Term Forecasting Model which should be kept in mind in assessing the results of the study[1] include the following:

- The Long-Term Forecasting Model is primarily an I/O model of the U.S. economy, generating a current matrix for each historical year and producing matrices for future years which embody technological change.

- The ADL I/O Table is one of the largest in use. It disaggregates the country's economy into 215 industries.

- The Long-Term Forecasting Model has many of the limitations of most I/O models: it is linear, does not have a feedback mechanism, treats each year separately, and is a model of a completely free economy. Many of the most important assumptions about the economy such as final demand, capital requirements and capacities must be determined exogenously. The use of industry specialists to elicit and evaluate the judgments of defense industry executives, as practiced in this study, is specifically designed to compensate for some of these limitations.

D. THE SELECTION OF THE TEST CASE

In the course of the study it became apparent that selection of the most meaningful test case would be a critical determinant of success since resources would not be adequate to support analysis of more than one test case under

[1] See Appendix A for a more detailed discussion of the Model.

the present contract[1]. A decision was then made to assume a doubling of defense procurement in a single year (1975), deemed likely to stress both the national economy and expose bottlenecks in key defense industries. Preliminary analysis quickly demonstrated that a doubling of orders in a single year would not produce a doubling of deliveries of weapons even in the following year--because of the lead times involved[2]. Lead time analysis indicated that, in fact, doubling procurement orders in a particular year would, broadly speaking, result in only a 20% increase in defense disbursements in each year spread over a five-year period. Exploratory

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[1] The contract terms of reference requested a study of mobilization capability "under parametric assumptions of intensity and length of conventional warfare hostilities". This implies study of more than one level of mobilization. The realization that detailed analysis of more than one test case would not be feasible, because of the scale and depth of the research required, developed only after methodology had been fully worked out and given a preliminary test.

[2] The experience of industrial mobilization at the time of the Korean War (June 1950-July 1953) is instructive with respect to the controlling influence of lead times. Expansion of military procurement, which had declined to a very low level following the demobilization of World War II, began essentially from "standstill" at the time of the surprise invasion of Korea from the north (the defense budget in 1951 had been originally set by the Administration--before the attack--at about $15 billion). Production of military hard goods was at that time running at a monthly rate of about $300 million. It took more than two years for that monthly rate to reach $2 billion (by which time truce negotiations had been underway for more than a year). Of the $129 billion appropriated by Congress for military procurement and construction following the invasion and up to October 1953 only $41 billion-worth had by that date been delivered or built, $60 billion was still on order and contracts for the remaining $28 billion were still to be let. See Defense Production Act, Progress Report No. 21, Hearing before the Joint Committee on Defense Production, 82d Congress, 2d Session, October 1, 1952. This report also contains a forecast (by then-Defense Mobilization Director Fowler) of the key issues to be faced in maintaining a mobilization base for the ensuing Cold War which remains remarkably applicable in today's setting of detente.

research showed, however, that even this relatively limited additional activity in the national economy in its projected state over the late '70's would be likely to stimulate inflation and a need for increased taxes, as well as precipitate strong competition between civilian and military demands, as well as among military orders themselves, in a number of industries. A judgment was thereupon made--fortunately confirmed in the later full-scale analysis--that it would be revealing to proceed with a test case at this level, amplified, however, by an additional surge of procurement in 1977 centered on an assumed major expansion of production in the aerospace industry--already recognized as the most likely industry to be inordinately stressed by mobilization[1].

It is the opinion of the study team--not, however, confirmed by detailed analysis--that levels of mobilization significantly lower than those of the test case could be handled by the economy at large and the defense industries in particular without inordinate competition with demands of the civilian economy or among themselves--and therefore that analyses of such test cases would not add much to the insights gleaned in this study. Similarly, the study team believes that significantly higher levels of mobilization than those employed in the test case would almost certainly require widespread resort to allocation, rationing and probably wage and price controls as well as far-ranging departures from monetary and budget policies characteristic of the "peacetime" economy assumed for the base case and the test case. Analyses of some variant cases to test these opinions may be worth doing, however, when and if funds are available.

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[1] There is some confirmation in recent history that a sharp increase in defense procurement at about the level selected for the test case can push the U.S. economy into an inflationary mode if butter as well as guns continues to be sought, i.e. if allocation, rationing, wage and price controls, and increased taxation are not resorted to, as was the case in the early years of the Vietnam War step-up. See Economic Impact of the Vietnam War, The Center for Strategic Studies, Georgetown University, June 1967, reviewing the economic impact of orders for conventional weapons placed by the Department of Defense in the fall and winter of 1965-66 with the result that, by the end of FY 1966, defense obligations were running at an annual rate of $22 billion above the level of 1964.

III. THE SETTING FOR THE STUDY

This chapter sets the stage for the evaluation of the ability of the United States to respond to a sharp increase in military procurement. We begin with a forecast of the gross national product of the U.S. and its components for the years between now and 1980. This forecast is based on present trends in defense procurement continuing through this decade. We then describe those industries which are most closely related to military procurement and the current balance between their capacities and the demands placed on them. The current domestic sociopolitical situation is then analyzed to determine what constraints, if any, might arise that would affect a mobilization. The final two sections of the chapter consist of a discussion of the ways in which the international setting is related to mobilization options and an analysis of the legal and administrative mechanisms that are available to the Government if a significant mobilization is undertaken.

A. THE U.S. ECONOMY - AN OUTLOOK TO 1980

The period selected for analysis is 1974 to 1980 and we therefore begin with a projection of the economic outlook over that period. It is described below and is derived primarily from the ADL input/output forecasting model and the judgments of ADL professional staff.

Annual real growth of the U.S. economy for the remainder of the 1970's is forecast to average 3.7%, well below the real growth rate of 4.5% during the 1960's. This growth rate assumes a gradual recovery from the 1974 supply-induced economic recession. Table 2 presents a summary of the GNP forecast which constitutes the base case.

The following assumptions and forecasts of important economic factors have been made:

- Inflation. The worldwide aggregate demand for raw materials during the late 1960's and early 1970's put extreme pressure on productive resources and subsequently on prices. Though aggregate demand has leveled off, higher than historical inflation will continue until sufficient industrial capacity has been purchased and wage earners have achieved wage increases sufficient to offset prior inflation. We have assumed that inflation will be at a rate of 8-10% per year for the next two years, falling off to 4.5%-6% per year by the end of the decade.

TABLE 2

BASE CASE FORECAST OF GNP AND ITS COMPONENTS
(Billions of 1974 Dollars)

	1973	1974	1975	1976	1977	1978	1979	1980	Annual Growth Rate 1974-1980
GNP[1]	1394.8	1378.5	1419.6	1467.3	1514.4	1572.6	1640.3	1712.0	3.7
Personal Consumption Expenditures	879.5	876.5	903.6	926.9	959.3	995.8	1035.6	1077.0	3.8
Gross Private Domestic Investment	218.4	203.9	215.3	224.9	233.3	242.4	252.1	261.9	4.3
Non-Residential	139.8	146.2	152.3	159.1	164.0	169.2	174.2	181.1	3.6
Structures	47.1	50.0	51.9	54.6	56.3	57.7	59.2	61.3	3.5
Producer Durable Equipment	92.7	96.2	100.4	104.5	107.7	111.5	115.0	119.8	3.8
Residential	63.0	46.9	52.2	54.8	57.5	60.4	64.9	67.8	6.4
Inventory	15.4	10.8	10.5	11.0	11.8	12.8	13.0	13.0	
Net Exports	-5.4	-7.5	-10.1	-4.2	-1.0	0	+2.0	+3.0	
Exports	110.8	120.5	119.9	129.7	135.2	140.1	143.4	146.0	2.2
Imports	116.2	128.0	130.0	133.9	136.2	140.1	141.4	143.0	1.9
Government Purchases	302.5	305.6	311.1	319.7	322.8	334.4	350.6	370.1	3.2
Federal	114.4	114.4	115.2	117.4	118.7	121.4	124.6	128.7	2.0
Defense	78.2	77.4	77.6	78.8	80.1	81.8	83.4	85.1	1.6
Non-Defense	36.2	37.0	37.6	38.6	38.6	39.6	41.2	43.6	2.7
State & Local	188.1	191.2	195.9	202.3	204.1	213.0	226.0	241.4	4.0

Source: ADL Forecasting Model

[1] GNP as estimated in mid-1974; later estimates have a somewhat more pessimistic tone with respect to the short-term economic growth rate.

- Employment. The below-average rate of real GNP growth will present employment obstacles for an expanding labor force. There will however be chronic shortages in a number of skill areas, such as tool and die machinists. The proportion of labor force to total population will increase, particularly because of the increasing desire and need for women to enter the labor force. The forecast for unemployment levels for the base case is 6.75% in 1975, gradually declining to 5.4% by 1980. As a result there will be increasing pressures on the Government to utilize employment maintenance policies.

- Consumption and Income. Over the short-term, in reaction to inflationary pressures on their budgets, consumers will reduce their savings rate. Over the long-term, per capita incomes will increase at an average of 2.8% per year; however, taxes will absorb a larger proportion, thereby dampening the growth rate in real disposable income. Nevertheless, family per capita incomes will rise more rapidly than in the past because of smaller family size. Household formations will be increasing as the post-WWII baby boom continues to move through the household-formation age bracket. This will exert a positive impact on growth in a wide variety of consumer durables, nondurables and services over the decade.

- Investment and the Business Cycle. Present economic conditions in the business sector can be characterized by capacity shortages in many industrial sectors, particularly in the raw materials sector. This has transmitted significant inflationary pressures throughout the entire system. Business spending on plant and equipment will be one of the most vigorous sectors in the economy over the next few years, increasing at the rate of 4.3% per year from 1974-1976. Over the short-term, the high rates of inflation and the business sector's voracious demand on the capital markets will keep interest rates at historically high levels to the detriment of the residential construction sector. By the latter part of the decade, however, sufficient capital will have been built up so that demand and supply for production, as well as money, will be more in bal-

ance, consequently reducing the rate of inflation and freeing more funds for the housing sector.

- Balance of Payments. The meteoric rise in the price of oil has created serious international financial problems of intermediation. Despite the fact that the United States is much less dependent upon imported oil than other industrialized countries, it can expect to incur significant trade deficits over the near-term. Over the long run, however, the United States trade position can be expected to improve somewhat for a number of reasons. To begin with, energy conservation and coal substitution programs should help to stabilize United States' dependence on imported oil after 1980. Second, trade policies will attempt to equalize the burdens of U.S. military expenditures abroad, as well as eliminate trade advantages accorded to a score of nations. Third, U.S. trade competitiveness vis-a-vis the rest of the industrial world should improve because of the nation's relatively abundant resource base. Finally, elimination of former trade barriers with the Communist bloc, particularly the Soviet Union and China, should enhance the U.S. trade position. While significant trade volume with these nations is not expected until the 80's, there should be a gradual increase over the next five years.

- Government Budget and Revenues. Government outlays will continue to rise. While no major new conflict is assumed in the base case, defense spending increases, although modest, will break with the substantial cutbacks of the past five years. (See Table 3.) Increases in defense spending will be needed to pay for the all-volunteer army, the military pension program, and the increasing sophistication (and price tags) of weapon systems. Non-defense spending will increase more rapidly than defense spending, with the major increases occurring in the areas of medical care, environmental control, energy research, mass transit and crime prevention. However, for the remainder of the decade, it will continue to be difficult to balance the federal budget as the goals of full employment clash with the desires of present and future administrations to reduce inflation by restraining government

TABLE 3

ASSUMED NATIONAL DEFENSE BUDGET OUTLAYS FOR THE BASELINE CASE
(Billions of 1974 Dollars)

NATIONAL DEFENSE	1973[1]	1974	1975	1976	1977	1978	1979	1980
DOD: Military								
Military Personnel	23.2	24.1	24.1	24.1	24.5	25.0	24.4	26.0
Retired Military Personnel	4.4	5.1	5.1	5.1	5.2	5.3	5.4	5.5
Operation and Maintenance	21.1	23.3	23.3	23.3	23.7	24.2	24.7	25.2
Procurement	15.7	15.1	15.5	15.9	16.1	16.4	16.8	17.1
Aircraft	4.4	4.4	5.1	4.8	4.9	5.0	5.1	5.2
Missiles	3.2	3.3	2.7	3.1	3.2	3.2	3.3	3.4
Weapons and Tracked Vehicles	.2	.3	.3	.4	.4	.4	.4	.4
Ships	2.0	2.0	2.2	2.2	2.3	2.3	2.3	2.4
Ammunition	1.1	1.0	1.0	1.1	1.1	1.1	1.1	1.2
Other[2]	4.8	4.1	3.7	4.3	4.3	4.4	4.5	4.6
Research and Development	8.2	8.4	8.3	8.5	8.7	8.9	9.0	9.2
Military Construction and Other	.9	2.4	2.0	1.9	1.9	2.0	2.0	2.0
Allowances[3]	-	.1	1.9	.7	.8	.8	.8	.8
Deduction for Offsetting Receipts	- .1	- .2	-	-	-	-	-	-
Subtotal:	73.3	78.4	80.2	79.5	80.9	82.6	84.1	85.8
DOD: Other[4]	2.7	2.2	2.7	2.7	2.7	2.8	2.9	2.9
TOTAL NATIONAL DEFENSE	76.0	80.6	82.9	82.2	83.6	85.4	87.0	88.7
Number of Active Military Personnel (thousands)	2,324	2,218	2,177	2,100	2,050	2,000	2,000	2,000

[1] 1973 figures are presented in 1973 dollars; all others are in 1974 dollars.

[2] Includes electronics and communications and other support equipment such as tactical support vehicles.

[3] Includes allowances for All-Volunteer Armed Forces, military retirement systems reform, and civilian and military pay raises for DOD.

[4] Military assistance, atomic energy, etc.

Source: The United States Budget, FY 1975 and ADL estimates.

spending. Tax reform will become a necessity in order to prevent large budget deficits and their attendant inflationary pressures. Continued strong increases in state and local spending will concentrate less on education and related areas than on meeting health, welfare, safety and environmental needs. The increases projected for state and local spending may require additional revenue sources. Thus, many communities will be forced to raise revenues by increasing current tax rates or introducing new levies.

- Industrial Structure and Defense Procurement. The impact that defense expenditures have on an economy depends, in part, on the industries called upon to produce defense goods and on the configuration of the country's industrial structure. We have incorporated these considerations into our analysis in the form of procurement coefficients and interindustry input/output tables[1]. Table 4, derived from the input/output analysis, presents the percentage of total production in each industry in 1974 that will be produced directly or indirectly for defense procurement programs. As Table 4 indicates, the following industries supply at least 10% of their total output, directly and indirectly, to defense:

  - ordnance (includes munitions, tactical and strategic missiles and other items)
  - shipbuilding
  - aircraft
  - communications equipment
  - non-electrical machine shop products
  - engineering and laboratory instruments

[1] Appendix A describes the way in which we used the ADL input/output tables to derive the impact of defense expenditures on industrial production. The Appendix also presents a number of important tables that can be used to test the implications of different levels of military procurement spending.

TABLE 4

U.S. INDUSTRIES WHICH SUPPLY DIRECTLY AND INDIRECTLY AT LEAST 1% OF THEIR 1974 DOMESTIC PRODUCTION TO THE DEFENSE PROCUREMENT CATEGORIES[1]
(based on 1974 procurement levels, in percentage form)

Industry	Missiles	Ships	Tanks	Ammunition	Aircraft	Other	Total
Ordnance	15.1	1.2	x	12.6	3.1	11.7	44.2
Ships	x	38.1	x	x	x	1.4	40.0
Aircraft	5.8	x	x	1.2	16.5	1.8	25.7
Communication Equipment	8.2	2.5	x	1.0	5.1	7.3	24.1
Machine Shop Products	4.1	1.1	x	2.9	3.2	4.0	15.3
Eng. & Lab. Instruments	1.3	x	x	x	9.5	1.3	13.2
Other Non-Ferrous Metals (silicon, titanium, uranium)	2.0	x	x	x	4.3	1.8	9.5
Resistors, Transformers	2.3	x	x	x	2.1	2.6	7.9
Dies, Accessories	2.3	x	x	x	2.1	2.1	7.2
Lead	1.2	1.2	x	x	2.3	1.4	6.5
Electric Motors	1.0	x	x	x	1.5	2.9	6.5
Machine Tools - Cutting	2.5	0.9	x	x	1.1	1.5	6.3
Semi-Conductors	1.2	1.2	x	x	2.3	1.4	6.5
Zinc	1.1	x	x	x	1.9	1.6	5.9
Engines & Turbines	x	2.7	x	x	x	2.3	5.6
Non-Ferrous Mining	1.1	x	x	x	1.7	1.5	5.6
Machine Tools - Forming	x	1.0	x	x	x	3.0	5.5
Aluminum	1.1	x	x	x	1.6	1.5	5.3

(cont'd)

x Less than 1%.

[1] See footnote at end of table.

TABLE 4 (Continued)

Industry	Missiles	Ships	Tanks	Ammunition	Aircraft	Other	Total
Mechanical Meas. Instr.	x	x	x	x	1.9	1.9	4.4
Iron Ore Mining	x	0.9	x	x	1.0	1.6	4.4
Pumps	x	2.6	x	x	x	x	4.2
Copper	x	x	x	x	1.0	1.2	4.2
Fabricated Platework	x	3.5	x	x	x	x	4.2
Material Handling Equip.	x	x	x	x	1.1	2.4	4.0
Electronic Tubes	1.1	x	x	x	1.1	1.2	4.0
Valves, Pipe Fittings	x	1.5	x	x	1.1	x	4.0
General Ind. Machinery	x	1.1	x	x	0.9	1.2	3.9
Stamp., Mach. Prods.	x	x	x	x	x	1.5	3.8
Intern. Comb. Engines	x	x	x	x	x	2.4	3.8
Iron & Steel	x	x	x	x	x	1.3	3.6
Motor Vehicles	x	x	x	x	x	3.0	3.3
Metal Work Equip.	x	x	x	x	x	1.9	3.1
Hardware, Plating	x	x	x	x	x	1.2	3.0
Elec., Lighting, Wiring	x	x	x	x	x	1.1	2.9
Miscellaneous Rubber Prods.	x	x	x	x	x	1.1	2.6
Truck Bodies	x	x	x	x	x	1.0	1.2

x Less than 1%.

Source: ADL Input/Output Table

FOOTNOTE FOR TABLE 4

The data presented in this table indicate the relative share of various industrial sector's domestic production purchased directly and indirectly in each of the major Department of Defense procurement categories. These estimates have been derived from relationships contained within the ADL input/output table supplemented by additional information by the (then) Office of Emergency Preparedness and Research Analysis Corporation. Because of definitional and industrial classification practices associated with input/output tables and a lack of recent sufficiently-detailed public data, certain estimates contained in this table may vary from those published in trade and industry information sources. The case in which this discrepancy is most apparent is in the aircraft industry. In input/output terms, this industry includes only those establishments whose primary activity is aircraft manufacture. Traditionally, industry analysts will define military aircraft manufacture within the aerospace industry which would also include certain portions of the communications equipment and ordnance sectors. In input/output terms, these two industry sectors are separately identified. As a result, the table indicates that approximately 26% of the aircraft industry's production is sold directly and indirectly to the Department of Defense. On the other hand, industry spokesmen often cite a higher estimate of aerospace sales to DOD. If indeed the data in the table were transformed to comply with traditional industry concepts, certain percentages of the ordnance and communications equipment industries' sales to DOD would be combined with aircraft's 26% to yield an estimate that is much greater. One of the prime strengths of an input/output table and approach to an impact analysis is that it offers substantial industry detail on the flow of goods and services among very interdependent sectors. Often such data require careful interpretation, especially when compared with other informational sources.

Table 5 summarizes the forecast rates of growth for the industries in Table 4. It should be noted that, on average, the capital-producing industries exhibit higher growth rates over the short term (1974-1977) than over the long term (1974-1980). Also, the demands on the nation's shipyards in the short term are forecast to continue at a high rate of growth, but may fall off toward the end of the decade. The remainder of the industries exhibit slower rates of growth over the short term than over the long term.

- Stockpile. We have assumed for the base line forecast that the United States Government will maintain its present policy with respect to the stockpiling of critical imported raw materials. The stockpile is designed to protect the United States' production capabilities in a period of national emergency. We do anticipate, however, that some materials in the stockpile will be sold in open markets periodically throughout the forecast period.

B. CAPACITY/DEMAND BALANCE OF DEFENSE-RELATED INDUSTRIES[1]

The ability of the nation to respond successfully to increasing defense expenditures depends greatly upon the capabilities of the defense production structure. The primary producers of defense-related equipment consist of numerous industries throughout the United States economy. For purposes of analysis, it is useful to distinguish between the final assembly, supply, and support industries, a total of eleven of which have been analyzed in this study.

The final assembly producers are the aerospace[2], shipbuilding, motor vehicle, and weapons and munitions industries. Except for the shipbuilding industry, the final assembly industries are presently operating at below average rates of capacity utilization. In aerospace and weapons and munitions this is primarily due to the recent declines in military

[1] Factors which are uniquely related to production of weapons are considered in Chapter VI.

[2] Fundamentally, the aerospace industry includes aircraft and parts of the electronics industry and ordnance industries, such as missiles.

TABLE 5

BASECASE PRODUCTION GROWTH RATES FOR THE MAJOR INDUSTRIAL PRODUCERS OF DEFENSE-RELATED EQUIPMENT

Industry	Annual Industrial Growth Rates 1974-80	1974-77
Ordnance	1.6	1.7
Ships	4.7	5.7
Aircraft	3.2	3.5
Communications Equipment	4.9	4.8
Misc. Non-Elect. Machine Shop Products	3.3	2.7
Eng. & Lab Instruments	4.5	4.2
Other Non-Ferrous Metals (Silicon, titanium, uranium)	3.9	3.5
Resistors, Transformers	2.9	2.6
Dies, Accessories	3.7	5.0
Lead	1.8	1.7
Electric Motors	3.7	3.7
Machine Tools - Cutting	4.4	5.0
Semiconductors	9.5	8.8
Zinc	2.2	2.1
Engines & Turbines	4.7	4.2
Non-Ferrous Mining	4.3	4.0
Machine Tools - Forming	4.1	4.8
Aluminum	5.3	4.9

Source: ADL Forecasting Model

equipment expenditures. The motor vehicle industry, unlike the other final assemblers, depends very little on defense contracting for its business. However, it is because its commercial business is depressed that there is significant excess capacity. The short-term economic outlook for these industries does not suggest any significant increases in their commercial markets.

Since the passage of the Merchant Marine Act in 1970, the shipbuilding industry has grown rapidly. Presently, the yards are producing at historically high levels with employment levels at the yards at post-World War II highs. Further, the high level of presently unfilled contracts suggests continued vigorous growth for the industry.

The supply industries consist of the electronics, machine tool, chemical, primary metal and energy industries. The ability of these industries to respond to increasing defense expenditure is extremely varied.

Due to the increased sophistication of military equipment, the electronics industries have become key suppliers in the military-industrial complex. The electronics industries consist of two distinct sectors--the equipment manufacturers (e.g., communication equipment) and the component manufacturers (e.g., semiconductors). Since the late 1960's both sectors of the electronics industries, particularly the components sector, have successfully increased the commercial markets for their high-technology production. Consequently, they have become less dependent upon defense contracts for their economic viability. Commercial markets are more profitable and the industry has recognized the commercial markets to be a key to continued growth. A hallmark of the electronics industries has been vigorous growth associated with rapid increases in productivity. The rapid rises in the demand for electronics production has created strains on the physical capacity within certain sectors of the industry. Also, recent chronic shortages of many critical materials have effectively limited the productive capabilities of the industry.

Presently, the machine tool industries are undergoing a boom, primarily because of the large demand for capital equipment in the United States. The production of machine tools utilized in defense production comprises less than 7.5% of the market. Lead times for machine tool deliveries are

very long. The industry is operating at high levels of capacity, but increasing production is primarily hampered by a shortage of skilled labor.

The productive capabilities of the primary metals industries were pushed to their limits in 1973. A slack in demand for metals has begun to occur in 1974, although recent capacity increases within the industries have not been great. Numerous sectors of the commercial market are still having difficulty obtaining the appropriate amount of metals. The requirements for defense production are for the more sophisticated types and forms of primary metal products. Still, defense-related production does not comprise a large percentage of metal production in the United States.

The chemical industry supplies less than 1% of its production for defense production-related activities. Even a sizable increase in defense production would not normally strain the overall resources of the industry. However, certain specific categories of chemical processing might be strained by an increasing military demand, only because of the present supply shortages which exist in certain segments of the market. In the first half of 1974, there were shortages of organic chemicals such as benzene, toluene, phenol, polyvinyl chloride, and polystyrene, and of inorganic chemicals such as caustic soda, soda ash, chlorine, phosphatic fertilizers, and titanium dioxide. Principal reasons for current shortages have been lack of capacity, raw materials shortages, and the availability of energy, particularly electrical.

The energy industry is facing rising raw material and capital costs, capacity shortages, environmental and safety constraints, and growing oil imports. Only about 1% of U.S. energy goes for defense production and another 3% for peacetime military operations. The price and availability of imported oil is a key uncertainty in the nation's energy outlook.

The support industries considered are the construction and transportation industries. Both of these two industries are dependent upon defense production for a very small portion of their activities. Presently there is slack capacity for most intercity transportation modes, although shortages in part due to inefficient utilization do exist (e.g. railroad boxcars). The construction industry is in a depression. High capital costs and building materials shortages are serious problems.

C. CONSTRAINTS ON MOBILIZATION IMPLICIT IN DOMESTIC SOCIOPOLITICAL FACTORS[1]

The vigor with which the United States can respond to a threat to its national interest, and hence its "preparedness", is not only a function of economic factors but social and political conditions as well. Social and political conditions act as productivity factors in an economic system and are influential in other ways. If the conditions are favorable, the system's capacity and capabilities can be extended a significant amount over what it can produce under unfavorable conditions.

In our analysis we have introduced four parameter sets that can be used to describe the sociopolitical conditions which are pertinent to evaluating the country's capability to absorb a sharp increase in defense spending. These sets include society's attitude toward increased military expenditures, its attitude toward increased taxes or cuts in social programs, society's willingness to experience governmental controls, and politicians' willingness to risk being associated with such efforts.

- Attitude of Society Toward Increased Military Expenditures. Military decisions in the next several years involving increases in expenditures face not only an unfavorable economic climate, but also an unfavorable sociopolitical climate. This situation, which would limit the options that the President and the Department of Defense would have in the case of a step-up in defense production, arises from the fact that there are a number of trends and competing national concerns rapidly capturing public awareness. These include: (a) the fear of a conventional conflict leading to a nuclear war; (b) a disenchantment with the military establishment by some; and (c) a desire to give priority to meeting domestic social and economic needs.

- Attitude of Society Toward Increased Taxation or Reduction in Budgetary Expenditures. Any major increase in defense spending beyond that which is planned will have to divert resources to pay

[1] For an elaboration of this section see Appendix G.

for it. The two most obvious alternatives (particularly if one rules out inflationary options) are increased taxes and reductions in other government programs. At the present time, and probably for the remainder of the decade, both of these options would meet very strong public opposition.

- Willingness to Experience Governmental Controls. Another set of options for allocating resources to emergency efforts is to impose widespread governmental controls or edicts such as rationing, price controls or an invocation of the allocation systems of the Defense Production Act. These options are likely to be very controversial.

- Political Risk Associated with Involvement. Before any President or political leader would give his support to an increased defense production effort he would no doubt weigh the political consequences. Naturally, this will depend, in part, on the nature of the emergency--which is impossible to predict at this time. The willingness of a political leader to take such a risk is, however, also a function of his popularity and hence the extent to which he can afford to take the risk.

In summary, as a consequence of both the present economic as well as the sociopolitical environment, a sharp increase in defense spending in response to a national emergency is likely to be more disturbing and hence to meet more opposition than at any other time in recent history. Furthermore, it appears likely that this situation will continue for at least the remainder of the decade. However, if the national interest were very clearly threatened and public opinion became supportive of a stepped up defense production effort, inflation could be dealt with by wage and price controls and increased taxes; materials shortages could be handled by utilizing existing stockpiles and rationing. The various social priorities, which have become so important, such as improved health programs, energy self-sufficiency, environmental protection, and improved mass transportation could all be held in abeyance for future attention.

D. RELEVANCE OF THE INTERNATIONAL SETTING

In an age when the world is becoming increasingly more interdependent a number of factors which relate to the international setting can be critical in determining the response capabilities of the United States to threats of military hostility. An analysis of the dynamic nature of these external constraints on U.S. mobilization planning is presented in Appendix H.

While our analysis has not explicitly incorporated these external factors into the evaluation of the test case, they are important considerations that must eventually become a part of a fully realistic analysis. Research can be conducted on industrial potential, bottlenecks, effects on domestic production, and the like, without any explicit assumptions about the specific reason for the mobilization under consideration. But some elements of the external international political environment will inevitably affect the mobilization process itself, and thus require consideration as parametric conditions for mobilization planning. Among these are:

- The overall state of international relations, which both contains the cause of the mobilization and will also be the source of reactions to it;
- The existing patterns of international treaties, particularly in the arms control field;
- International interdependencies in such matters as the need for critical mineral resources or food.

Specific factors which fall into the first class and for which assumptions need to be made include, for example:

- The status of allied economics;
- The status of sea lanes of communications;
- The need of allies for continued U.S. exports, particularly military hardware.

Treaties, if observed, also set limits on certain aspects of mobilization. They may have the further signifi-

cance that breach of their provisions would generate consequences both in the international environment and in the U.S. posture.

Quite aside from treaties, but sometimes more significant in determining policy, are needs for access to vital resources or markets.

Our scenario-free analysis has not been carried to a level of specificity where any of these factors has been considered explicitly as a constraint. In a more comprehensive analysis of a specific scenario they would have to be looked into carefully. However, Appendix E contains a suggestive exploration of a number of such possibilities.

E. LEGAL AND ADMINISTRATIVE MECHANISMS FOR INDUSTRIAL MOBILIZATION

For almost three decades, since the closing years of World War II, the U.S. Government has maintained a standby management structure, and the underlying legal framework to enable it to intervene in the economy if necessary to assure priority treatment for defense-related production[1]. The Office of Preparedness, in the General Services Administration, functions as the coordinator of mobilization planning and implementation; the Department of Commerce and the Department of Defense have primary responsibility for the civilian and military sectors. This apparatus has been activated from time to time to break minor bottlenecks in the flow of defense-related production, and during the Korean and Vietnam conflicts, for more far-reaching purposes. Its existence represents a resource in being which can be called upon by relatively routine administrative decisions at subcabinet level if needed in the kinds of industrial mobilization which are considered in this study. It is subject only to the continuing approval of the President and does not require separate Congressional action, at least during the

[1] The Defense Production Act of 1950, 50 USC §§ 2061-2167 gives the U.S. Government authority to control resources to meet defense needs. Additional significant legislation includes: The National Security Act, 50 USC §§ 402, 404, 405; The Strategic and Critical Materials Stockpiling Act, 50 USC § 98; The Trade Expansion Act, 19 USC § 1862 (1962). These laws are supplemented by a series of Executive Orders.

initial stages of a mobilization effort[1]. The Congress, however, has established watchdog procedures to keep these far-reaching powers of the Administration under surveillance and, to put teeth in its surveillance, extends the basic legal authority only two years at a time. It also has established a Joint Committee on Defense Production which holds annual hearings on the Executive Agencies' stewardship with respect to these powers[2].

The capacity of this standby system to function at a level of activity which would put it under stress has not been tested since the Korean War. The Vietnam conflict, despite its dimensions in other ways, created relatively modest production problems for the U.S. manufacturing and supply economy. Our necessarily cursory review of the administrative system suggests that it has the capacity to react in a timely and comprehensive fashion to almost any foreseeable range of need for priorities and allocations linked to mobilization programs. The regular Congressional reviews of performance and readiness, coupled with occasional special studies which have been initiated by the Executive, indicate the standby managerial and legal machinery for mobilization is not likely to represent an important constraint in the areas which are the focus of this study[3]. However, in the course

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[1] Executive Order #10480: "The Director of the Office of Defense Mobilization shall, on behalf of the President, coordinate all mobilization activities of the Executive Branch of the Government, including all activities relating to production, procurement, manpower, stabilization and transport." Executive Order #11051: "The Director of the Office of Emergency Planning shall (a) advise and assist the President in the coordination of and in the determination of policy for the emergency plans and preparedness assignments of the Federal departments and agencies ... to meet all conditions of national emergency including attack on the United States."

[2] See, for example, The Twenty-third Annual Report of the Activities of the Joint Committee on Defense Production, 93rd Congress, 1st and 2nd sessions (1974).

[3] See also George A. Lincoln, "Role of OEP in Mobilization Planning," Defense Management Journal, Vol. 8, October 8, 1972, pp. 41-45.

of our interviews with officials responsible for maintaining the system, we detected some concerns over divisions of responsibility, possible gaps between agencies, and other indications of a lack of full coordination. We were not, however, in a position to pursue these matters in the present study since they would require a searching and extensive inquiry as a basis for evaluation.

For completeness we include, in Appendix F, a description of the present standby mobilization system.

IV. A TEST CASE FOR MOBILIZATION

A. INTRODUCTION

In this chapter we describe a hypothetical case designed to disturb the system's base case as presented in Chapter III. We refer to this hypothetical design as a test case. It is defined parametrically without a specific scenario associated with it. The only assumptions we have made that differ from the base case refer to defense procurement.

We have assumed that an exogenous "factor" in the international sociopolitical arena has appeared in 1974 which has induced a willingness on the part of the American Government and public to increase military spending sharply. The "factor" is not so great as to be perceived as creating an overwhelming national emergency. Therefore, it is assumed that the Government has no desire to disrupt the national economy by imposing widespread and total allocation controls to assure defense production where bottlenecks may occur[1].

In Chapters V and VI we then present an evaluation of the impact a mobilization like that of the test case would have on the national economy and on the key defense industries. This evaluation takes into account changes in industrial inputs and outputs derived from applying the ADL Forecasting Model to the test case as well as an appraisal by the ADL industry specialists of the implications of these changes for specific defense industries.

B. DESCRIPTION OF THE TEST CASE

The test case is composed of two procurement phases --conventional and strategic procurement. As described in

[1] The assumption that widespread and total government intervention is not imposed on the private sector is very important. It is highly unlikely that the Government would intervene (except in a few instances as has occurred from time to time under "normal" defense procurement conditions) unless the external event leading to the increased spending were a major threat and so perceived throughout the United States. If this were the case, the U.S. economy could perform at significantly higher defense production levels than can be measured under peacetime assumptions, although at higher cost to the civilian sector.

Chapter II, for the conventional procurement phase we chose to double the 1974 level. This represents an additional $15 billion above the base case planned procurement, beginning in 1975. The strategic phase of the test case consists of an additional $15 billion procurement above the base case beginning in 1977. We have assumed the same conditions as in the base case; however, a number of additional assumptions must be added to this setting:

- It is assumed that the rate of additional expenditures for the conventional procurement programs corresponds to production/delivery schedules for the various procurement categories as estimated by industry executives. The number of years assumed to be required for each category is as follows:

  - munitions - 1 year
  - weapons and tracked vehicles - 2 years
  - aircraft and tactical missiles - 3 years
  - ships - 4 years
  - other procurement - 2 years

  Thus, the expenditures for an additional $15 billion of conventional procurement programs have been spread out over four years. Further, because very precise information on the actual assembly cycle for procurement categories is not available, it is assumed that expenditures for any year are distributed with respect to the total inputs of the final product.

- It has been assumed that industrial purchases in the operations and maintenance category will be 20% higher each year than in the base case in order to insure adequate maintenance for the additional inventory.

- It has been assumed that there will be no significant increase in military personnel over the base case. Some selective increases in skilled personnel, however, would in fact be necessary to handle the enlarged inventory.

- For the strategic phase of the test case, purchases break down into $5 billion for the Trident and Minuteman missiles and $5 billion for the B-1 bomber. All expenditures are distributed equally over the 1977-80 period.

- The conventional phase emphasizes a broad step-up in defense spending involving diverse industries. The strategic phase emphasizes a step-up impacting upon the aerospace industry and its suppliers. It is intended to focus on possible saturation effects.

Table 6 presents a summary of the military procurement expenditure outlays assumed for the baseline and test cases. It should be noted that the percentage increases of the test case over the base case decrease after 1977. Therefore, on average, the stepped-up procurement program of the test case will have less and less impact on the economy as the decade progresses after 1977. Also, since the economy will be growing, this will increase the absorptive capabilities of the industrial structure to meet additional demands.

TABLE 6

MILITARY PROCUREMENT PURCHASES FOR THE BASELINE CASE AND THE TEST CASE
(Billions of 1974 Dollars)

	1974		1975			1976			1977			1978			1979			1980		
	BC*	TC**	BC*	TC**	%***	BC*	TC**	%***	BC*	TC**	%***	BC*	TC**	%***	BC*	TC**	%***	BC*	TC**	%***
Aircraft	$ 4.40	$ 4.40	$ 4.80	$ 6.05	26	$ 4.80	$ 6.05	25	$ 4.90	$ 7.27	48	$ 5.00	$ 6.24	25	$ 5.10	$ 6.34	24	$ 5.19	$ 6.44	24
Ships	2.00	2.00	2.20	2.70	23	2.20	2.80	27	2.30	2.80	22	2.30	2.80	22	2.30	2.30	0	2.39	2.39	0
Missiles	3.30	3.30	3.00	3.89	30	3.09	3.89	26	3.21	6.40	99	3.21	5.91	84	3.30	5.91	79	3.30	5.91	79
Ammunition	.99	.99	.99	1.98	100	1.11	1.11	0	1.11	1.11	0	1.11	1.11	0	1.11	1.11	0	1.20	1.20	0
Weapons[1]	.29	.29	.29	.45	55	.41	.54	32	.41	.41	0	.41	.41	0	.41	.41	0	.41	.41	0
Other Proc.[2]	4.10	4.10	4.10	6.14	50	4.30	6.36	49	4.30	4.30	0	4.40	4.40	0	4.49	4.49	0	4.61	4.61	0
Oper/Maint.[3]	11.70	11.70	11.65	14.04	21	11.65	14.04	21	11.84	14.28	21	12.10	14.52	20	12.35	14.77	20	12.60	15.12	20
R & D	10.36	10.36	10.64	10.64	0	10.36	10.36	0	10.92	10.92	0	11.20	11.20	0	11.34	11.34	0	11.62	11.62	0
TOTAL	37.14	37.14	37.67	45.91	22	37.92	45.12	19	38.99	47.49	22	39.73	46.59	17	40.40	46.67	16	41.32	47.78	15

1 Includes tracked vehicles.
2 Includes electronics and communication and other support equipment such as tactical support vehicles.
3 Purchases do not include salary expenditures for military and non-military personnel.

* Baseline Case.
** Test Case.
*** Percentage difference between baseline case and test case.

Source: ADL Forecasting Model

V. AN EVALUATION OF THE TEST CASE FROM A MACROECONOMIC PERSPECTIVE

The test case has been evaluated from both a macro- and a microeconomic perspective. In both instances the ADL Forecasting Model was used to generate forecasts of industry sales and employment that would result from the test case. The macroeconomic analysis then sought out the implications for the overall economy whereas the microeconomic analysis evaluated individual industries' capacities to achieve the projected levels of production in the specified period. The micro analysis was based on a combination of the industry interviews with the knowledge of the ADL industry specialists, taking into account the results obtained from use of the Forecasting Model. This chapter is concerned with macro-economic effects.

The analysis of the test case shows that the total additional demand on the U.S. economy created by the test case (summarized in Table 7) is relatively small. As indicated in Table 7 total industrial output would increase only 1.2% over the base case through 1977, and less thereafter.

If economic resources (capital and labor) were completely mobile and substitutable in the short-run, the United States could most likely produce the additional defense equipment without any significant adverse effects on the economy. However, economic resources are not particularly mobile or substitutable in the short-run. Further, because of the special nature of military procurement, very few firms provide the final product, and final assembly has become highly concentrated geographically. Therefore, if constraints or adverse effects do occur within the economy, they are likely to occur in particular industries or regions at first. The ripple effects of these constraints may, subsequently, lead to the development of other bottlenecks elsewhere in the economy.

One of the most serious problems the test case would be likely to create is additional inflation. The added inflationary pressures would come as a result of:

- Significant increases in manpower at some final assembly plants, which would increase unit labor costs because of productivity decreases as well as increases in wage rates required to attract labor.

TABLE 7

OVERALL DEMANDS ON THE ECONOMY UNDER THE BASE CASE AND TEST CASE

	1975	1976	1977	1978	1979	1980
	TOTAL INDUSTRIAL SALES[1] (Billions of 1974 Dollars)					
Test Case	2,623	2,725	2,827	2,922	3,043	3,156
Base Case	2,591	2,694	2,799	2,897	3,021	3,136
Test Case/Base Case	101.2%	101.1%	101.0%	100.8%	100.7%	100.6%
	INDUSTRIAL EMPLOYMENT (in millions)					
Test Case	69.10	70.07	71.15	71.76	73.07	74.59
Base Case	68.25	69.23	70.24	71.14	72.56	74.02
Additional Manpower	.85	.84	.81	.62	.51	.57

Source: ADL Forecasting Model

[1] "Total Industrial Sales" represents the aggregate of final and intermediate output, as opposed to Gross National Product which measures only final output.

- Price increases for intermediate goods and services, which would probably be necessary to make military contracts as profitable as production for some alternate civilian markets.

- Increasing demands for raw materials in the short-run, which would stimulate further raw material price increases which, in turn, would be passed through the entire economic system.

The magnitude of the inflationary impact is difficult to assess. It is primarily a function of the economic setting in which the price increases occur. At the time of mobilization, should the economy be in a stage of the business cycle characterized by overcapacity and slackness in most industrial sectors and rising unemployment, the inflationary impact of the above price increases would likely be less than that expected in an economic setting already beset with high rates of price inflation, tight productive capacity, and supply shortages of selected materials. While compensatory fiscal and monetary policy actions could mitigate adverse inflationary impacts, the historical record of the 1950's and 1960's indicate that such fine-tuning of the economy is rather difficult.

Financing for the stepped up military expenditures would most likely come from increased taxes for a number of reasons:

- There is presently a significant need for business investment in new plant and equipment, and deficit financing would exacerbate the problems of an already capital-short economy.

- Inflationary pressures from supply shortages would intensify, if taxes were not increased, because the procurement program would otherwise induce a substantial increase in aggregate demand. Although the tax increase would cut per capita consumer spending, there would be a slight net increase in final demand consumption induced as a result of increased employment. This slight increase in final demand has been incorporated into the test case analysis.

- Financing through taxation would allow government non-defense spending to continue unaltered.

The adverse macroeconomic impacts would be most severe at the beginning of the step-up. However, as industrial capacity increases during the remainder of the decade, these obstacles could be expected to become less severe, reducing inflationary and supply pressures.

An additional macroeconomic factor which could be impacted under a mobilization scenario is the U.S. balance of trade. Presently, the value of imported goods into the U.S. is rising rapidly as a result of higher prices for crude oil and refined petroleum product imports. As a result, the balance of trade is expected to remain in a deficit situation over the next several years. Our ability to manage such an occurence requires that the balance remain at an "acceptable" level by spurring growth in exports while attempting to limit imports. Should a rapid mobilization effort of the order described in our test case (or greater) be undertaken, it may impact our trade balance adversely due to:

- Increased imports of selected materials in order to meet the needs of defense suppliers; and
- Limits (voluntary or legislated) on exports to divert greater amounts of domestic capacity toward meeting the mobilization needs.

Either action, which may be necessary under a mobilization effort, would aggravate an already troublesome balance of trade situation for the U.S.

As mentioned earlier particular regions would be hard hit both in a build-up and a phase-down of military procurement. Without the use of precise regional input/output tables and the regional distribution of the procurement that would occur under the test case, it is not possible to calculate exactly the total impacts on the regional economies that would occur. However, an indication of the potential impacts which increased defense expenditures would have on regions can be inferred from the level of concentration of primary defense-related employment. Table 8 does provide a measure of the "defense employment dependency" with respect to total employment which existed in 1970 for the major defense producing regions of the United States.

The states presented in Table 8 include the greatest employment related to defense prime contracts and are arranged by region of the nation. The SMSA's within the

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TABLE 8

THE TEN MAJOR STATES AND SELECTED SMSA's[1] IN THE UNITED STATES RECEIVING DEPARTMENT OF DEFENSE PRIME CONTRACTS (1970)

	Primary Defense Employment (000's)		Total Employment (000's)		Defense Employment to Total Employment (%)	
UNITED STATES		996.0		76,554		1.3
West						
CALIFORNIA		216.5		7,484		2.9
Los Angeles	108.0		2,826		3.8	
Anaheim/Santa Ana/Garden Grove	34.0		544		6.3	
San Diego	26.0		430		6.1	
San Jose	33.0		409		8.1	
San Francisco	5.0		1,267		0.4	
South						
TEXAS		87.9		4,141		2.1
Dallas	36.0		665		5.4	
Fort Worth	35.0		310		11.3	
MISSOURI		35.9		1,767		2.0
St. Louis	27.0		898		3.0	
Kansas City	9.0		520		1.7	
Midwest						
INDIANA		37.1		2,016		1.8
Indianapolis	8.0		444		1.8	
OHIO		48.3		4,063		1.2
Cleveland	10.0		828		1.2	
Akron	8.0		260		3.1	
East						
PENNSYLVANIA		44.4		4,536		1.0
Philadelphia	32.0		1,878		1.7	
NEW JERSEY		33.6		2,858		1.2
Newark	10.0		762		1.3	
Paterson/Clifton/ Passaic	15.0		576		2.6	

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TABLE 8 (Continued)

	Primary Defense Employment (000's)		Total Employment (000's)		Defense Employment to Total Employment (%)	
NEW YORK		75.1		7,124		1.1
New York	40.0		4,607		0.9	
Buffalo	6.0		509		1.2	
Rochester	5.0		355		1.4	
Binghampton	10.0		116		8.6	
CONNECTICUT		61.7		1,252		4.9
MASSACHUSETTS		46.9		2,298		2.0
Boston	27.0		1,136		2.4	
Selected Additional SMSA's						
West						
Seattle/Everett	13.0		556		2.3	
Phoenix	5.0		362		1.4	
Denver	5.0		492		1.0	
Midwest						
Chicago	13.0		2,852		.5	
Minneapolis/ St. Paul	21.0		759		2.8	
Detroit	5.0		1,570		.3	
East						
Baltimore	18.0		810		2.2	
Washington, D.C. (with suburbs)	8.0		1,179		.7	

Source: City and County Data Book

states are ranked by total employment. It can be seen that, on average, the smaller regions within the states are more heavily dependent upon primary defense production for employment than are the larger regions. Therefore, it can be argued that if the increasing defense expenditures were allocated primarily to the larger metropolitan areas of the country, the additional demands imposed upon the regional economies would create less disruptive diversions of resources than if the procurement allocation were allotted to the smaller, more highly defense-oriented regions. For example, assuming that both areas were experiencing similar defense production and overall economic conditions when a step-up occurred, New York City would be able to absorb a doubling of defense activity much more readily than Binghamton, N.Y., because the additional demands imposed upon New York City's economic resources on a relative basis would not be nearly as great as the imposition on the economic resources of Binghamton.

Summarizing: The macroeconomic effects of the test case mobilization would be principally in its potential inflationary influences. Import and export trade would also be likely to be affected in undesirable ways. The regional effects will depend on the mix of orders and their geographical dispersions; under some possible patterns, regional impact could be perceptible. On the whole, however, at the macroeconomic level the U.S. economy seems able to respond to the test case mobilization without grave difficulty, although with some undesirable side effects.

VI. IMPACT OF THE TEST CASE ON DEFENSE-RELATED INDUSTRY: A MICROECONOMIC PERSPECTIVE

A. INTRODUCTION

The macroeconomic analysis of the test case considers broad national effects, overall impacts on industries, and interrelationships between industries arising from defense procurement. However, very particular bottlenecks and impacts may not necessarily be detected at such a level of analysis because available economic data may not be detailed enough. Furthermore, the capacity of plants and industries as normally measured in "peacetime" economic data may understate their true capacity for multishift operation during a mobilization.

As a complement to the macroeconomic analysis, we therefore undertook what could be described as microeconomic analysis, drawing our insights from a substantial program of meetings between ADL industry specialists and senior executives knowledgeable in estimating the specific impact of the test case increase in defense procurement on their own operations. To select an appropriate list of executives, we determined which corporations were the prime contractors for the weapon system programs involving the largest procurement dollars in each of several categories during FY '74 and FY '75. The weapon system categories were conventional aircraft, tactical missiles, ships, tracked combat vehicles, and strategic offensive and defensive systems (see Table 9). The systems selected represent four-fifths of FY '74 and FY '75 acquisition costs of key weapon systems. ADL specialist staff met with defense industry staff at the level of program manager and higher with each prime contractor. We also normally arranged meetings with other top executives such as vice presidents for manufacturing, engineering, procurement, and marketing.

Prime contractors often purchase from one thousand or more suppliers. As the party with overall responsibility for final delivery, the prime contractor must be aware of lead times, materials availability, and other operating conditions of its suppliers. Yet only the suppliers themselves are fully aware of their own capacity utilization, competing demand from civilian orders and other military programs, and many additional factors vital to a mobilization. For this reason ADL specialists also met with top executives of key suppliers which are leaders in their industry and are each

TABLE 9

WEAPON SYSTEMS ANALYZED IN THIS STUDY

System	Prime Contractor	Category	Procurement FY '74 Quantity	Procurement FY '74 $ Million	Procurement FY '75 Request Quantity	Procurement FY '75 Request $ Million
		STRATEGIC PROGRAMS				
I. Offensive (Triad)						
Minuteman	Boeing/GE	Air Force Land-Based Missile	115	712	61	731
Poseidon	Lockheed	Navy Submarine-Launched Missile	<100	137	0	48
Trident C-4	Lockheed	Navy Submarine-Launched Missile	RDT&E	533	RDT&E	661
Trident Submarine	General Dynamics	Navy Missile-Launching Submarine	1	922	2	1381
B-1	Rockwell	Air Force Bomber	RDT&E	463	RDT&E	439
Navy	Lockheed/G.E./ McDonnell Douglas	Air Force and Navy Maneuverable Re-entry Vehicle Study	RDT&E	90	RDT&E	120
II. Defensive						
Safeguard (* Continuation at 1 Site)	Western Electric	Army Anti-Ballistic Missile Defense	0*	341	0*	61
Site Defense	McDonnell Douglas	Army Anti-Ballistic Missile Defense	RDT&E	110	RDT&E	160
		CONVENTIONAL PROGRAMS				
I. Aircraft						
E-3A AWACS	Boeing	Air Force Communications Command Plane	RDT&E	193	12	770
F-4 Phantom	McDonnell Douglas	Air Force/Navy Fighter	24	100	0	16
F-15 Eagle	McDonnell Douglas	Air Force Fighter	62	1129	72	1076
F-14 Tomcat	Grumman	Navy Fighter	50	737	50	756
P-3C Orion	Lockheed	Navy Patrol Plane	19	202	12	151
[illegible]	[illegible]	Navy Patrol Plane	45	553	45	574
AH-1G Huey Tow	Textron (Bell Helicopter)	Army Attack Helicopter	RDT&E	7	21	29
AH-1J Sea Cobra	Textron (Bell Helicopter)	Navy Attack Helicopter	11	25	20	31
[illegible]	Textron (Bell Helicopter)	Army Utility Helicopter	150	41	205	69
[illegible]	Textron (Bell Helicopter)	Navy Utility Helicopter	24	23	20	17

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TABLE 9 (Continued)

System	Prime Contractor	Category	Procurement FY '74 Quantity	Procurement FY '74 $ Million	Procurement FY '75 Request Quantity	Procurement FY '75 Request $ Million
CONVENTIONAL PROGRAMS (CONTINUED)						
II. Missiles						
Hawk	Raytheon	Army Ground-to-Air Missile	950	121	750	101
Maverick	Hughes	Air Force Ground-to-Air Missile	3000	59	6000	88
Phoenix	Hughes	Navy Air-to-Air Missile	240	92	340	95
Sidewinder	Raytheon, Philco-Ford	Navy Air-to-Air Missile	850	15	800	16
Sparrow	Raytheon, General Dynamics	Air Force Air-to-Air Missile	175	46	600	88
TOW	Hughes	Army Ground-to-Ground Missile	23,425	143	30,319	138
III. Ships						
CVN-70	Tenneco (Newport News)	Navy Nuclear Aircraft Carrier	1	951	0	0
DD-963	Litton (Ingalls)	Navy Destroyer	7	590	7	463
DLGN-38	Tenneco (Newport News)	Navy Nuclear Escort	0	81	1	246
SSN-688	Tenneco (Newport News)/ General Dynamics (Electric Boat Div.	Navy Nuclear Attack Submarine	5	920	3	512
IV. Tracked Combat Vehicles						
M60A1 Tank	Chrysler	Army Tank	613	214	664	237
XM-1 Tank	G.M./Chrysler	Army Tank	RDT&E	54	RDT&E	69
ARSV	FMC/Lockheed	Army Reconnaissance Vehicle	0	10	35	33
M113A1	FMC	Army Personnel Carrier	923	44	0	0
M125A1	FMC	Army Mortar Carrier	105	6	13	1

involved in numerous military programs. This series of meetings went all the way back to the raw material stage.

The companies whose executives we met are in eleven industries grouped into final assembly, supply, and support categories:

Final Assembly	Supply	Support
Aircraft	Electronics	Construction
Shipbuilding	Machine Tools	Transportation
Ordnance	Primary Metals	
Motor Vehicles	Chemicals	
	Energy	

This chapter presents the results of this evaluation of the test case from a microeconomic perspective, assessing the capability of prime contractors and their suppliers to meet the stepped up defense production requirements, and the bottlenecks and adverse side effects which are foreseen as likely to be experienced. The conclusions are built upon the individual judgments of executives, labor leaders, and military project officers with whom we met, combined with the judgment of ADL industry specialists knowledgeable about military and civilian production. The analysis begins with a discussion of general principles of industrial production which would affect stepped up production of any weapon system. It concludes with an analysis of specific bottlenecks likely to arise which would limit industrial capacity in the industries affected.

Five appendices for this study have been assembled on the basis of this research program. Appendix B briefly summarizes published information on the current status of each conventional weapon system which was the subject of meetings with program managers. Appendix C discusses in depth the production and deployment problems anticipated in each of the

five key offensive and defensive strategic systems[1]. Appendix D contains a brief description of each corporate prime contractor and, in some cases, suppliers with whom we met, and refers to selected defense contracts which they have received. Appendix E extends and details the material about the impact of the test case on each of the eleven key industries examined in this study. Appendix F lists the executives, labor leaders, and military officers with whom we discussed these problems.

B. GENERAL PRINCIPLES OF DEFENSE PRODUCTION WHICH AFFECT MOBILIZATION

During FY '74, out of total DOD procurement of more than $37 billion, the United States procured major weapon systems valued at about $15 billion, most of which were produced by the aerospace industry and its suppliers (see Table 9). As noted earlier, a first phase of the test case assumes a doubling of FY '74 procurement for conventional systems, followed by a strategic phase beginning in 1977.

The time, cost and effectiveness of a step-up in defense production would be significantly affected by the status of weapon systems production at the time the mobilization begins. Key parameters include:

- Position in the development/production cycle;
- Complexity of the weapon system;
- Willingness to utilize "off-the-shelf" models;

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[1] The majority of our effort was focused on 25 conventional systems. We chose to include the strategic systems, however, because they were limited in number and permitted an analysis of trade-offs for deployment between systems which would not have been possible with a sampling of a similar number of conventional systems. Another important consideration was the fact that the program managers for strategic systems seemed, as a group, even more motivated to participation in this study than conventional system managers, presumably because SALT has made them particularly aware of the relevance of arms control agreements to their operations.

- Lead times for tooling up and obtaining inputs;
- In-process and component inventories; and
- Relationships between time, performance, and cost factors.

When weapons are still in the development stage, the time to complete development, design exact specifications, place orders with suppliers, and manufacture is generally several years. Examples of systems still in development are the XM-1 tank, Trident strategic missile, and the B-1 bomber. Likewise it may also take a long time to reestablish a supply network for weapons already in operation but no longer being produced. As a result of this time lag, stepping up production of systems currently being manufactured is the most rapid alternative. It generally is easier to step up production when the production level is increasing or at a high level because the prime contractor and its suppliers are experienced and have already committed a great deal of human, tooling, and other resources to the effort. For weapons nearing the end of their production cycle, much of the supply pipeline may be drying up and the effort to expand production would take longer.

Weapon systems may differ widely in their complexity and the production effort required to make them. Ships (especially nuclear submarines), strategic missiles and bombers, and air superiority fighters take several years to produce under the best of conditions because the electronics, castings and forgings, and other components are very sophisticated and large in quantity per weapon system.

The complexity of modern weapons makes their redesign and testing of the new components quite time-consuming. A change in one part may require redesign and testing of several interrelated items. An example is the fact that even a small change in a strategic missile's length, width, or weight would require extensive modifications in its on-board electronics, launch control, and other equipment. Significant changes in components after orders to suppliers have been placed are especially disruptive since it requires coordination of redesign, production, and testing activity of many organizations. A willingness by the U.S. Government to commit itself to the procurement of weapon system versions which have already been produced or are in production would reduce delivery times.

The lead times needed for tooling up are a function of factors such as the existence of underutilized facilities (including unutilized multishift potential) for a prime contractor, for alternate primes, and for suppliers, and delivery times for facilities and tooling that are needed to expand existing capacity. Deliveries of long lead time components from suppliers generally take longer than the time for the prime contractor to tool up because there are several hundred suppliers involved which may have their own tooling and supplier problems. Lead times for suppliers in 1974 are especially long.

Manufacturers generally have an in-process inventory of partially finished goods and inventories of components, materials, and sub-systems to be used in manufacturing which are somewhat greater than current needs. The component inventories are built up with some excess as a hedge against supply disruptions or inflation. A rapid step-up in production could benefit from an accelerated completion of in-process inventory and faster utilization of other inventories. However, this effect of "pumping out" what is already in the supplier "pipeline" is only an initial acceleration of limited dimensions which cannot substitute for the placing of entirely new orders with their lengthy production schedules. Due to their complexity, it is difficult to reduce the usual time to produce the first delivery of new orders of these systems even if more money and government compulsory powers over suppliers were made available.

However, the time to produce a large number of subsequent deliveries can be reduced if prime contractor and supplier facilities and personnel are built up extensively for a large, but short, burst of activity. However, the cost of these redundant facilities and personnel will be much higher than if the delivery schedule permitted a gradual build-up followed by extended manufacturing activity with less equipment.

There are many trade-offs between time and cost. Likewise there can be trade-offs between performance and cost. The military requires a very high level of performance and reliability as a minumum. Improving a system's performance from "very high" to "very, very high" may be essential in certain combat situations, yet production time and cost may be increased. A "typical" production schedule involves a low level of initial deliveries as the supply network and final assembly facilities are built up and efficiency is

improved along a learning curve. Production is gradually stepped up and deliveries steeply climb. Then, towards the end of the program, production is gradually slowed down and phased out. The basic principle is to meet military delivery schedules with a production effort which, hopefully, minimizes contractor and supplier disruption and avoids investment in expensive facilities which would be used only for short, intense spurts of manufacturing.

C. EFFECTS OF THE TEST CASE ON FINAL ASSEMBLY INDUSTRIES[1]

The industries which are final assemblers of military hardware include the aircraft, shipbuilding, ordnance, and motor vehicles industries. Table 10 summarizes the incremental production and employment demands upon these final assemblers arising from the test case as defined by the ADL Forecasting Model. These were the estimates used by the ADL industry specialists in their interviews with industry executives to illustrate the probable impact of the test case in each industry.

1. Aircraft

As shown in Table 10, the test case calls for a rate of increase in production three times greater than that of the base case. Judging from its current and expected capabilities, it would appear that the industry would be hard pressed to meet the production schedule set forth in the test case. Although there is at present idle physical capacity in the aircraft industry, the additional manpower of 250,000 required by 1977 for the test case would be an increase of approximately 40% over the industry's present work force. While this level of employment barely exceeds that achieved in the late 1960's, the industry is highly concentrated geographically and would find it difficult to locate and bring that many new workers on stream. Since the employment in the industry has been dropping quite rapidly since 1970, it is likely that the industry might not be able to reattract former workers.

[1] See Appendix E for a more detailed discussion.

TABLE 10

PRODUCTION AND EMPLOYMENT
DEMANDS ON FINAL ASSEMBLERS

	Production (Millions of 1974 dollars)			Employment (000's)	
	1974	1977	Annual Growth Rate 1974-1977 (%)	1974	1977
Aircraft					
Test Case	26,433	39,635	10.6	600	860
Base Case	26,433	29,306	3.5	600	610
Difference	--	10,329	7.1	--	250
Shipbuilding					
Test Case	3,843	6,668	20.0	132	218
Base Case	3,843	4,576	5.9	132	150
Difference	--	2,092	14.1	--	68
Ordnance					
Test Case	8,265	13,220	16.9	163	237
Base Case	8,265	8,694	1.7	163	156
Difference	--	4,526	15.2	--	81
Motor Vehicles					
Test Case	68,446	73,063	2.0	796	821
Base Case	68,446	72,635	2.0	796	815
Difference	--	428	--	--	6

Source: ADL Forecasting Model

Not only would the traditional aircraft companies be affected by such a step-up, but also many of the supporting and feeder industries would have serious problems im meeting the demands for rapid increases in capacity. Lead times for many key supplies have already lengthened appreciably, such as for electronics, castings and forgings.

This leads to a number of tentative conclusions. The first is that if the test case production schedules were met, the cost of materials, added facilities and worker training would offset many of the economies of scale. Second, the Government might have to offer financial incentives for the industry to increase the production of military aircraft at the expense of commercial production. Third, the Government might restrict exports of military hardware, although at a cost. Aircraft executives are reluctant, however, to divert resources from civilian to military contracts without a clear and publicly recognized national emergency. If export production facilities were "converted", political as well as balance of payments problems would be created.

2. Shipbuilding

Shipbuilding industry bottlenecks created by the test case levels of production would prove to be more difficult to overcome than in the aircraft industry. The industry is presently solidly booked for civilian and Navy business, nd the short-term baseline forecast indicates continued strong growth in shipyard activity.

Manpower would appear to be the most serious constraint to rapid increases in shipbuilding demand. Employment levels in the industry have reached post-World War II highs, and it can be assumed that there is no reservoir of former employees from which to draw. Nevertheless, since there is a degree of interchangeability between the construction trades and the shipbuilding trades, the bleak forecast for the construction industry over the next few years may enlarge the labor pool from which shipbuilding could draw. However, the regional nature of the shipbuilding industry would serve as a deterrent for massive, large-scale hiring from the construction industry. A number of major shipyards in the United States are located in small metropolitan areas such as Bath, Maine and Pascagoula, Mississippi, and mobility in the construction trades is inhibited by local union practices. In addition, the need

to attract a new pool of employees would undoubtedly require wage incentives which would result in increased costs.

The shipbuilding industry is highly susceptible to the secondary effects of shortages in its supplier industries, both in regard to labor and materials, and is strongly dependent on long-lead time components, including nuclear propulsion plant elements.

In the materials field, the potential shortages would appear to lie in the area of manufactured components rather than in raw materials as such. In many items, sporadic shortages would occur. An accelerated program would in itself aggravate these shortages and extend the already long lead times existing in the industry. Facilities would appear to be of least concern. For the most part, their utilization could be increased provided the manpower could be found.

Although manpower problems and shortages would undoubtedly extend some lead times, the industry would appear to be able to handle the increase envisioned in the test case. Requests for shorter lead times or more ships would, however, be progressively more difficult.

3. Ordnance

The ordnance industry, under the assumptions of the test case, would receive a significant boost in growth over the base case forecast. The analysis of the missile manufacturing portion of the industry is similar to the findings regarding the aircraft industry described above.

Of all the defense-related industries, the munitions portion of the ordnance industry is the one in which the Government is most involved as a producer. This is done through arsenals and Government-owned, contractor-operated (GOCO) plants producing ammunition, bombs, explosives and torpedoes. A large, rapid increase in munitions output would appear possible for several reasons:

- Although safety precautions to avoid explosions are an important concern, the manufacturing processes are relatively simple;
- GOCO plants have substantial production capacity, except for a small number of low-

demand, high-production cost items. As recently as the late 1960's, munitions procurement was $7 billion per year during the height of the Vietnam War; although some facilities are no longer in operation, this total is three and one-half times larger than current procurement of total munitions;

- A number of U.S. corporations have the necessary production know-how;
- Military demand for the chemicals and metals needed is a very small portion of total domestic supply. For example, only 1% of the current supply of ammonia, a key basic material for explosives and propellants, goes for military munitions needs.

4. Motor Vehicles

The motor vehicle industry has enormous productive capacity and only an extremely small production of this sector's output goes to military procurement programs. From an overall industry perspective, it would not likely experience production problems under the conditions of the test case. However, production capacity for civilian goods is not easily converted to defense production of specialized weapon systems such as tanks. Furthermore, key supplies of tank turret and hull castings are already difficult to obtain. Therefore, a step-up can be expected to create certain tooling, supply and other problems

D. EFFECTS OF THE TEST CASE ON SUPPLY INDUSTRIES[1]

The primary supply industries for defense production are the electronics industries, machine tools industries, primary metals industries, chemical industries, and the energy producers. Table 11 is a presentation of the additional demands created by the test case upon the most important specific intermediate supplying industries as defined in the ADL Input/Output Table. The impact on supplying industries not reported in Table 11 would be at a level not considered significant. As in the case of the final assembly industries, the data on test case impact reported in Table 11 provided the framework for the industry interviews designed to assess the effects of the test case.

[1] See Appendix E for a more detailed discussion.

TABLE 11

ANNUAL GROWTH RATE FOR PRODUCTION, 1974-77
FOR SPECIFIC MAJOR INTERMEDIATE SUPPLIERS
FOR THE TEST CASE AND THE BASE CASE

Industry	Test Case (%)	Base Case (%)	Incremental Difference (%)
Engineering and Laboratory Instruments	13.9	4.2	9.7
Miscellaneous Non-Electrical Machine Shop Products	11.8	2.7	9.1
Radio and TV Communications Equipment	13.8	4.8	9.0
Resistors, Transformers	6.7	2.6	4.9
Non-Ferrous Metals (Silicon, Titanium and Uranium)	8.1	4.0	4.1
Lead	5.1	1.7	3.4
Dies, Accessories	8.2	5.0	3.2
Machine Tools - Cutting	8.2	5.0	3.2
Aluminum	7.9	4.9	3.0
Zinc	4.8	2.1	2.7
Semiconductors	10.9	8.8	2.1
Machine Tools - Forming	6.6	4.8	1.8
Engines and Turbines	5.9	4.2	1.7
Electrical Motors	5.3	3.7	1.6

Source: ADL Forecasting Model

The primary difficulties would arise from chronic raw material shortages, current high levels of capacity utilization and long delivery backlogs. It should be noted that small levels of increased demand could, in fact, be absorbed by even those industries that are operating at full capacity, because of the extra production capabilities and efficiencies that can be induced through patriotism and other motivational stimulants. Even so, increases in demand on limited supplies and productive capacity would not only add fuel to the inflation cycle, but also to the total cost of the program, which would offset many of the economies of scale arising from stepped up procurement.

1. Electronics

The electronics industry would face a large incremental demand generated by the test case because it is already heavily involved in defense markets. Difficulties in its responding would arise from selected raw material shortages, current high levels of capacity utilization, long delivery backlogs, and the profit appeal of civilian markets.

The electronics industry could expand or accelerate production of two or three major strategic or conventional systems without serious problems, particularly if the increases entailed only the production of existing systems, or equipment currently in production. However, if final assemblers were hard pressed to obtain additional supplies from the existing defense supply network, "new" suppliers would be needed within particular industries. Establishing additional suppliers is a very complicated and time-consuming process because of the paperwork and testing required for defense-related production. Because of the small volume of defense sales with respect to their total sales, and the cyclical nature of defense contracting, many intermediate supply industries would be extremely reluctant to divert resources from civilian to military contracts. Furthermore, they consider civilian contracts to be generally more profitable than defense contracts. Thus many intermediate supply firms would not divert production to defense contracts without some sort of inducement, particularly financial. Shortages of electronic components would have an adverse impact on accelerated delivery schedules unless Defense Production Act reallocations of shipments were to be applied to component suppliers. This is probably the key mobilization problem for electronics.

If, on the other hand, the simultaneous step-up of six to ten major strategic or conventional programs were to take place, or if major modifications of present

systems were called for, such as a Minuteman IV replacing Minuteman III, or if entirely new systems were required to replace existing systems, major problems would be encountered by the electronics industry. These problems would be mostly in the areas of component supplies, availability of production and assembly facilities, and shortage of skilled and trained personnel in both engineering and manufacturing disciplines.

Since the electronics industry, at both the equipment manufacturing and component stages, has substantial civilian demand, diversion of capacity away from civilian customers as well as expansion of overall capacity would be necessary to meet a large step-up in defense production.

2. Machine Tools

Less than 10% of total machine tool output currently goes to defense production. Despite the existence of government-owned equipment and government machine tool programs, additional machine tool production for a significantly larger defense effort would be necessary. Expanded machine tool production could come from two sources; namely, increased total production, or commercial production or export production diverted to the defense effort. To some degree domestic supply could be supplemented by imports.

The machine tool industry is experiencing heavy civilian demand and delivery lead times have become very long. The main bottleneck in increasing defense output is the shortage of skilled machinists willing to work in machine tool manufacturing. Also, the capital goods producing industries may continue to face significant civilian demand pressures over the immediate term as a result of high business outlays for new equipment.

The manufacture of the bulk of military hardware can be accomplished with general purpose machine tools as opposed to the very large or special machine tools such as the huge turning machines used in the forging industry for work-in-progress machining and the very special large 5-axis "skin mills" for the aircraft industry. Even if the industry could not supply more than the number of general purpose machines it is now producing, at this high level of metalworking machine tool production, a mobilization effort could draw on the large supply of new tools being produced for less critical industries to fill its general purpose needs.

The aircraft manufacturing industry and its subcontracting machine shops are currently quite well supplied with the large, very special machines that it needs and could sustain moderately higher production rates. However, at high levels of activity, such as a one-year doubling of military procurement, new large and special purpose machinery would be required. Diversion of production of these machines away from less critical industries would be of limited value since little production of the very large machine tools goes on for nondefense industry anyhow. However, some are imported from overseas sources, such as West Germany, and this source might be utilized to some degree. This lack of additional large and special machine capacity could limit our ability to raise weapon system production levels quickly. The problem would be most acute in the large forging industry where limited work-in-process machining capability might limit the increased production of large forgings in the short term. The airframe and aircraft engine industries might be next in line to feel such a constraint.

3. Primary Metals: Forgings and Castings

Relatively modest percentages of the nation's primary metal industries' output are procured directly or indirectly for weapon systems. Defense procurement is expected in 1974 to consume only 3.6% of domestic iron and steel production and 5.3% of the domestic aluminum production. Since the U.S. is a net importer of both iron and steel, and aluminum, defense usage represents an even smaller percentage of total domestic consumption.

There appears to be adequate capacity in the primary iron and steel industry to supply whatever needs might be required for defense applications including even specialty alloy steel. However, it might well be that certain non-essential civilian end uses for iron and steel would not be able to get all of the steel needed were the government to divert certain production units already operating at capacity to satisfy increased defense requirements assuming foreign-sourced materials were not available. As far as aluminum is concerned, much the same situation prevails as in the case of iron and steel.

Within the primary metals industry, the nonferrous metals and mining (which includes titanium and uranium) would be the only sector measurably affected by the increase in defense spending associated with the test

case. Yet, total defense-related production would not have to increase by more than 4% of total output. However, given the present tight supply/demand situation within the primary metals industries, increasing defense demand by even a small amount could further accelerate inflationary price rises under free market conditions. A potential solution for eradicating shortages or accelerated inflation which may occur within the non-ferrous sector is to sell materials from the U.S. stockpile. Sales of excess inventory are permissible under the law which established the stockpile. However, throughout 1973 and 1974, the government accelerated sales of stockpile inventory without having an appreciable effect on the substantial price increases which have occured throughout the raw material sector. A very large increase in military demand for titanium metal used in aircraft, aircraft engines, and other hardware might require significant growth in titanium sponge imports, or diversion of metal used for commercial aircraft production. Either alternative, particularly the latter, would have adverse balance of payments effects.

This study assumes continued access to imports, although at this time world demand is already pressing on world supply of many minerals. Incremental imports for military production would probably come in part at the expense of the demand of U.S. civilians or U.S. Allies. A recent study by Arthur D. Little for the U.S. Government indicates that the U.S. economy could continue to function effectively even if there were a total, one-year cutoff of all mineral imports if allocations were made away from less essential civilian uses and the national stockpile were utilized. Cutoffs lasting more than one year, but involving at least partial imports of any mineral, could probably be handled.

Forging and casting is a major activity conducted primarily by large, specialized forging companies and separate casting companies, which forge or cast many different metals but do not generally produce metals themselves. Military aircraft and propulsion systems require large forgings and castings which can be produced by relatively few suppliers. Such components are used for civilian and military aircraft, aircraft engines, naval nuclear reactors, tank hulls, turrets, and strategic systems. A broad step-up in defense production would put great pressure on leading forging and casting companies.

4. Chemicals

Although the chemical industry supplies a wide variety of products to the Department of Defense, they still represent only a small percentage of total chemical industry sales. About 1%, or $1 billion, is sold directly to the Department of Defense. Another few percent are sold to other industries involved in defense production, such as plastics for military hardware, synthetic rubber for tires, and propellants for munitions and rockets. What is sold to DOD or to defense producers is very rarely specific to military needs. Rather, the same chemicals are almost always produced in volumes many times larger for civilian applications.

Even a sizable increase in defense production would probably not strain the overall resources of the industry. Several qualifications to this generalization should, however, be noted. There is limited flexibility in converting equipment from the processing of one type of chemical to the processing of others. During boom times, such as during the 1973-1974 period, specific products have been in short supply and capacity has been strained. In recent years, feedstocks have become limited. Certain specific categories of chemical processing might be strained in response to increased defense production, while the industry as a whole remained only marginally affected.

5. Energy

Energy is used both by industries producing for the military as well as by the military itself.

Just as defense procurement accounts for only about 2% to 3% of total U.S. manufacturing, so defense-oriented production consumes roughly the same proportion and mix of energy. A doubling of defense procurement in a single year would increase defense production energy consumption by roughly one-third per year for each of the three years in which the items procured were produced. This would represent a very small annual increase in overall energy consumption and cannot be considered a serious constraint on mobilization at the test case level. But since the supply of domestic oil, gas, coal, and nuclear energy is relatively inflexible, such increased energy demand would have to be met by some combination of increased oil imports (at considerable cost), diversion of energy sources from civilian usage (disruptive to the economy), and/or to some extent from more efficient utilization of existing energy (very difficult in practice).

Petroleum represents almost one-half of U.S. energy supply. Approximately one-third of U.S. petroleum is imported. The stepped-up defense production of the test case by itself would not severely cut into civilian oil supply. Yet a step-up coupled with a foreign embargo of oil imports could create serious problems. Under these circumstances a mobilization, even at the test case level, could be the "straw that broke the camel's back". The petroleum shortfall incurred during the height of the Arab embargo was approximately 1.5-1.8 million barrels per day, or 8% to 10% of imports.

Thus continued access to imports by the United States, rather than the small increase in defense-related energy consumption, must be considered the key variable in determining the degree of hardship which the civilian sector would face during a mobilization at the test case level.

E. EFFECTS OF THE TEST CASE ON SUPPORT INDUSTRIES[1]

1. Construction

Most industries would meet increased defense production needs, short of long-term massive mobilization, with their existing plants. This factor plus the large total capacity of the construction industry indicates that, on an overall national basis, the industry could handle most potential increases in defense production, but not without some difficulties. Existing problems of building material cost and availability, as well as energy, manpower, and capital availability, would be exacerbated, and some dislocations would occur in certain regions of the country. If a step-up in defense-related construction were concurrent with a general pick-up in the national construction industry from its current depressed state, consideration might be given to building supply and distribution controls.

2. Transportation

Within the transportation industry, each mode (railroads, trucking, pipelines, inland waterways, airlines) could absorb the very small incremental demand arising from the projected increase in defense production. Yet the U.S. Government may need to intervene occasionally to overcome bottlenecks such as facilities' deterioration and boxcar shortages in the case of the railroads.

[1] See Appendix E for a more detailed discussion.

VII. SUMMARY AND CONCLUSIONS

A. THE KEY FINDING

The principal question addressed in this study is whether U.S. industrial mobilization capability requires improvement to meet the variety of demands which could be placed upon it in an evolving environment of arms control and detente. The simple answer is that improvement is required.

The hypothetical limited mobilization case tested in the analysis of this study shows that, under foreseeable economic and sociopolitical conditions in the United States during the balance of the 1970's, a sharp increase in defense procurement orders having the scale and mix assumed, would be likely to encounter bottlenecks in aircraft assembly, shipbuilding, electronics, castings and forgings, machine tools, and--in some regions--in the construction industry. Other, regionally-oriented bottlenecks might also appear in industries which, on a national basis, would have adequate capacity. Energy supply for the mobilization would not represent a problem in the absence of a cut-off or serious reduction in the supply of imported petroleum.

The limited mobilization of the test case would have undesirable secondary effects under presently foreseeable conditions in the U.S. economy: heightened inflation, increased imports, pressures to restrict exports, and competition for capital goods needed to deal with critical structural changes in the economy, such as in the energy field. The possibility of a resort to allocation of key items or materials, employing the legal powers of the Defense Production Act and related legislation, would have to be faced.

B. U.S. INDUSTRIAL MOBILIZATION CAPABILITY

The difficulties which face the limited mobilization considered in this study may seem surprising in view of the scale and power of the U.S. industrial economy as a whole. In sheer physical terms, its capacity to supply the goods and services which could be called for by a mobilization at almost any conceivable scale over the next decade, is overwhelming. Weapon system procurement at the 1974 level of $15.1 billion takes place in an economy where the Gross National Product this year will be on the order of $1,370 billion. Weapon system procurement thus is equivalent to only slightly more than 1% of GNP. Expanding this share many times over in a mobilization effort would, at first glance, appear to present few problems.

However, as the test case analysis shows, even a simple doubling of conventional weapon system procurement in 1975 accompanied by accelerated RDT&E and deployment schedules for key strategic systems would very seriously strain capabilities. The nature of the constraints that lie at the root of this anomalous condition are discussed below.

On the other hand, the analysis indicates that, having passed through the uncomfortable first few years of a mobilization scaled like that of the test case, the economy--and even the overstressed key industries--would find a new equilibrium, with expanded capacity; and inflationary pressures--from this source at least--would subside. The disturbing effects are thus seen primarily as short- rather than long-term in their undesirable consequences.

In addition, a number of lingering benefits could be derived from a modest mobilization and a phased demobilization. One benefit would be the additional capacity in currently constrained industries which would be created by the military buildup. Another benefit could be that the mobilization effort could put the economy on a long-term, upward business trend, thereby creating jobs and additional income that would carry over even beyond the demobilization period.

The timing of the mobilization--i.e., at which point in the national economic cycle it occurs--is a key variable in determining the extent and kind of both macroeconomic and industrial impacts, since the availability or lack of spare capacity will strongly influence the reaction of suppliers of all kinds.

C. SOCIOPOLITICAL CONSTRAINTS ON INDUSTRIAL MOBILIZATION

Social and political attitudes, and the underlying conditions which generate them, act as productivity factors in the economic system and in other ways critically affect the capacity to mobilize. The presence or absence of a sense of urgency and commitment conditions the lead times required to move a procurement program from the Defense Department to the White House, through the appropriations process and into the procurement system. These factors also critically affect productivity through their impact on the will of the executive, the union leader, and the production

worker to change traditional ways in the interest of getting the job done--and their attitudes as voters monitoring the performance of the political leadership.

For example, many of the constraints that would make difficult a limited mobilization such as that envisioned in the test case would be eased or removed in a large-scale mobilization such as that which accompanied World War II when society as a whole--after initial doubts--perceived the situation as one posing a fundamental challenge to national survival. The determining factor would be, of course, not the scale of the mobilization but the motivation for it. In fact, increasing the scale of a mobilization much beyond that of the test case in the absence of compelling psychological motivation affecting a very wide segment of the population appears likely to be nearly impossible in the kind of society into which the U.S. has evolved over the last decade.

Interviews in the study indicate that a broad segment of industrial and labor leaders would be reluctant to modify existing operations to accommodate a mobilization program unless there were a clear, widely accepted "national emergency". Many said that they would have to perceive and evaluate the threat for themselves regardless of Presidential or DOD announcements. This attitude exists today even among executives with a lifetime commitment to defense production and personal experience as high-ranking DOD officials. One can speculate that it stems from a combination of factors in recent history--the Vietnam War, disenchantment with what is seen as the cyclical nature and low profitability of defense production, and the attractiveness of civilian markets which have until recently been booming.

These considerations, coupled with the fact of current negative public attitudes toward increased military expenditures; toward increased taxation or decreased welfare expenditures; and toward rationing, allocation or price controls make it foreseeable that a sharp increase in defense spending is likely to be more disturbing and hence likely to meet more opposition in the near future than at any other time in recent history. Observing these facts emphasizes their significance as a basic constraint on the mobilization process.

D. CONSTRAINTS IMPOSED BY THE INTERNATIONAL SETTING

Another constraint both on freedom to take mobilization action and on the effectiveness of mobilization itself to which the analysis in the study directs attention is the international setting in which the mobilization is assumed to take place. Factors in international relations may, in fact, foreclose the leadership's option to make mobilization effective by limiting its ability to communicate, either to the nation or to our allies, its perception of the existence of a serious threat to national security or survival. Under some circumstances to do so would simultaneously be provocative to the source of the threat, increasing the risk of conflict escalation through feedback. Potential side effects of mobilization, such as restrictions on exports to friendly countries or preclusive buying of scarce materials or energy resources may also be so serious in terms of their impact on alliances or trade as to require abstention from or unwanted moderation in mobilization measures.

E. CONSTRAINTS IMPOSED BY LEAD TIMES

Another set of basic constraints on the pace and scale of mobilization identified in the study lies in the massive administrative effort and paperwork of the defense appropriation and procurement process itself, the RDT&E lead times involved in moving to new or modified complex weapons or weapon systems, and the extended supply purchase and assembly periods required in the production of major items such as advanced fighter aircraft, ships, or strategic missiles and their launching platforms. These constraints will operate quite independently of the scale of the mobilization and can be relieved only after the passage of one or more years following the decision to move from one level of production, or one system design, to another.

The time necessary for first delivery of additional units of a weapon system beyond current delivery rates generally cannot be shortened significantly by greater expenditures and even by the utilization of Defense Production Act compulsory powers. This is so because the effort to manufacture a modern weapon system requires the coordination of hundreds or thousands of suppliers. Further, in the case of weapons already in production, to double the monthly delivery rate under the best of conditions would take roughly one year for tanks, two or more for aircraft and missiles, and even longer for ships. It is apparent, therefore, that a large-scale war,

unless it lasted a minimum of one year, or even two or three years, would have to be fought largely with inventory in existence at the time the war started.

F. MACROECONOMIC CONSTRAINTS

In one sense there are no significant macroeconomic constraints on mobilization in the huge U.S. economy. In another sense, macroeconomic constraints--or at least concern about possible macroeconomic effects--can make decisions to mobilize difficult. The principal concern in an economy like that forecast to 1980 will be inflationary effects. These are certain even in a limited mobilization at the level of the test case. Forestalling inflation, through increased taxation for example, is a policy option that is available but from which national leaders may shrink in view of its possibly adverse political consequences. Not as painful, from a political point of view, would be the interference likely in heavily impacted industries with production for the civilian economy. At the level of the test case mobilization this would pose inconveniences but hardly more. Effects on import and export trade are a more serious concern. Increased imports and probably reduced exports can be expected and, in the perspective of the balance of trade forecast for the rest of this decade, would aggravate an already troublesome economic problem area.

G. POLICY OPTIONS FOR IMPROVING MOBILIZATION CAPABILITY

Many of the constraints on an industrial mobilization arise from factors which, to a large extent, are beyond the control of the mobilization program planner or manager. This is certainly the case with the sociopolitical, international and macroeconomic constraints and, to a certain extent, it is also true for the production lead time constraints. In part for this reason, only minimal effort has been expended in the study on defining the directions in which steps to improve U.S. mobilization capability should go. Nevertheless, on the basis of insights developed in the study, it is possible to point out areas in the preparedness system where effort might be rewarded with improvement.

One such area is the standby organization for industrial mobilization. The principal issue here appears to be the level at which the primary mobilization coordination responsibility is fixed within the Executive Branch; in 1973 it

was moved from the White House to a more subordinate position, within the General Services Administration. The link with arms control explored in this study may not have been fully appreciated when the 1973 decision was made and its emerging significance suggests that a different disposition should at least be considered. We also found that some officials familiar with the preparedness system feel concern over divisions of responsibility, possible gaps between agencies, and a lack of full coordination. An effort to confirm these views and develop remedies for such deficiencies as are verified seems warranted.

The other principal options for improving capability in advance of a mobilization appear to be:

- Expanded stockpiling--to include key long lead time components and machine tools;
- Maintenance of a "warm production base" in selected product lines, to shorten production lead times.
- Continued improvement of the "Trigger Order" program of DOD, also to shorten procurement lead times;
- Continued critical review of procurement practices;
- Improvement of the effectiveness of present levels and types of financial incentives to producers.

A principal difficulty with most of these options lies in their cost. An effort to define such costs and weigh these against the intangible benefits of an improved mobilization capability would be complex but, we think, worthwhile.

These directions for improvement in mobilization capability are primarily relevant to the pre-mobilization phase. Once a decision to mount an industrial mobilization has been taken, however, most of the foregoing avenues to greater capability will be overshadowed, in determining the effectiveness of the effort, by the quality of the leadership committed to convincing the country that the mobilization deserves support at the sacrifice of personal and financial interests. Legal compulsion and financial incentives can complement but cannot substitute for such a perception. And even with widespread consensus on the importance of an industrial mobilization. the sociopolitical, international, macroeconomic, and many of the production lead time constraints on the mobilization defined in this study will challenge it.

H. THE USE OF MOBILIZATION IN ARMS CONTROL PROGRAM MANAGEMENT

There appear to be limitations on the usefulness of industrial mobilization in arms control program management, including resort to mobilization as a signalling device or as a bargaining chip in disarmament negotiations. These are indicated by the findings of this study that the mobilization mechanism at best is ponderous, with long lead times for achieving significantly expanded deliveries, that even a limited mobilization program such as that hypothesized in the test case of the study, while feasible, can send inflationary and destabilizing ripples through the economy, and that both domestic and international sociopolitical side effects of serious dimensions are foreseeable. Nevertheless, there may well be situations in which limited industrial mobilization should be considered a viable policy option, even though its initiation may be fraught with far-reaching consequences not to be lightly dismissed. However, these consequences can be assessed best--and most realistically--within the context of a specific mobilization scenario since their probabilities are intimately dependent on assumptions about the real world in which the mobilization decision is to be made. Such assessments, based on the data and methodology presented in this report, should be carried out and will no doubt lead to continued progress in understanding how mobilization measures can be designed and used, in a real world setting, both to strengthen U.S. security in an environment of controlled disarmament and to influence constructively the bargaining process itself.